

# PATENT SPECIFICATION

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## (54) AN APPARATUS FOR EFFECTING TREATMENT OF AN ELONGATE PIECE OF PHOTOGRAPHIC MATERIAL

(71) We, WAINCO PRODUCTS LIMITED, a British Company, of 4—6, Cromwell Road, St. Neots, Cambridgeshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an apparatus for effecting treatment of an elongate piece of photographic material, for example a piece of photographic film or film print material.

According to the present invention there is provided an apparatus for effecting treatment of an elongate piece of photographic material comprising a plurality of baths for containing photographic treatment materials, a plurality of spaced clips adapted to engage a lateral edge region of the material, and means for moving the clips along a predetermined sinuous path through the baths, thereby to transport the piece of photographic material along the said path.

Two embodiments of the invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a diagrammatic view of the general arrangement of an embodiment of the present invention;

Figure 2 is an enlarged side view of a first form of clip for use in the present invention;

Figure 3 shows a first form of drive wheel forming part of the embodiment of Figure 1;

Figure 4 is an end view of the wheel shown in Figure 3;

Figure 5 is an end view of a second form of clip for use in an embodiment of the invention;

Figure 6 is a side view of a wheel for use in conjunction with the clip shown in Figure 5;

Figure 7 is an end view of the wheel shown in Figure 6; and

Figure 8 shows an alternative form of

drive wheel for use in conjunction with the clip shown in Figure 5.

Figure 1 shows a film processing tank 1 which is divided by partitions 2 into a number of separate baths. In the form of tank shown in Figure 1 there is successively provided a developer bath 3, a bleach bath 4, a washing bath 5, a fixer bath 6, a further washing bath 7, and a stabilizer bath 8. This tank is suitable for developing a colour print film. It will be appreciated, however, that the present invention is equally applicable to any other form of film development which requires a plurality of baths, and that other types of film would require different successions of baths. A drying zone 9 is also provided.

A continuous belt 10, formed, for example, of a Mylar strip ("Mylar" is a Registered Trade Mark), is arranged to travel in the direction indicated by the arrow 11 through the processing installation. The belt passes in a sinuous fashion through the tank 1, being guided for this purpose by a plurality of crowned guide rollers 12. After leaving the tank 1, the belt passes into and through the drying zone 9, and is returned to the tank 1 via a wheel 13. The construction of this wheel will be described in more detail below with reference to Figures 3 and 4. Secured to the belt 10 are a plurality of clips; these clips are not shown in Figures 1, but are illustrated in Figure 2. The clips are spaced along the belt at equal intervals, the interval between adjacent clips being exactly equal to half the circumference of the wheel 13. The reason for this will become apparent in the detailed description below of the operation of the wheel 13. A length of film 14 which is to be processed is introduced into the apparatus at the left hand side thereof, and one lateral edge thereof is engaged in the region of the wheel 13 by a plurality of the clips. When the film is very narrow it is necessary to ensure that the

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spacing of the clips is such that the clips engage the film between adjacent frames. The plane of the film is substantially parallel to the plane of the belt 10. The film is then carried by the belt through the processing tank, thence through the dryer 9, and so back to the upper side of the wheel 13. At this point the clips disengage the film which is then free to pass out of the apparatus.

A film detector 15, illustrated only schematically, is positioned after the wheel 13. The purpose of this detector is to sense when the film 14 has passed sufficiently far into the apparatus for a further section of film 14 to be introduced. It will be appreciated that as the belt 10 is considerably longer than a typical length of film to be processed, a substantial number of film lengths can be processed simultaneously. Figure 1 also shows splash guards 16 which are designed to prevent liquid in one bath splashing over into an adjacent bath, a danger which is present particularly when the tail of a film length is entering a bath. It will be observed that the roller provided at the top of the partition 2 dividing baths 3 and 4 has a layer 17 of resilient material, for example a foam plastics material, provided thereon. The purpose of this layer is to remove as completely as possible any developer which may be present on the clips as they leave the developer tank. It will be seen that unlike the bleach and fixer baths the developer bath is not immediately followed by a wash, and for this reason it is important to ensure as far as possible that no developer is carried out of the developer tank to contaminate succeeding baths. It has been found in practice that developer absorbed by the layer 17 drips almost entirely back into the developer bath 3, and very little enters the bleach bath 4. Means are provided for agitating the liquids in the tank, and means are also provided for maintaining the liquids at an appropriate temperature. Both these means are entirely conventional in construction, and well known in the art, and it is not believed that any description of them is necessary. A roller 18 which is positioned at the entry of the belt into the drying zone 9 is also covered with a layer of resilient material, in this case to produce as much drying as possible of the clips before the belt carrying the film enters the drying zone.

Reference will now be made to Figure 2 which illustrates on an enlarged scale, a clip 20 used to engage a lateral edge of the film. The clip 20 comprises a U-shaped member 21, and a pair of parallel plates 22 which engage the belt 10. A U-shaped film engaging member 23 has one of its arms received in apertures 24 in the member 21 and is spring-loaded by a spring 25 which urges it towards the lower of the two arms

of the member 21. The member 23 has a pointed end 26, and in use a film to be transported is engaged between the pointed end and the adjacent part of the member 21. The lower end of the spring 25 bears against a circular plate 27 which is riveted to member 23.

Figures 3 and 4 show in more detail the wheel 13. This wheel has three functions; it drives the belt 10, it causes the clips 20 to engage an incoming film, and it causes the clips 20 to disengage an outgoing film. To fulfill the first of these functions the wheel is provided with a suitable drive (not shown) which could be, for example, an electric motor. The wheel comprises a central core 28 and a pair of side plates 29. For convenience each side plate can be sub-divided into two halves, as shown in Figure 3. The side plates 29 have a central aperture 30, and a lateral extension 31 from the core 28 extends into the aperture in each side plate 29. Each extension 31 is provided with a pair of cut-outs 32 in which a cam follower 33 is pivotally mounted. For simplicity of illustration only one of the cam followers is shown. Each cam follower 33 is mounted to be pivotal about an axis 34 and is biased by a spring [not shown] into contact with a stationary cam 35.

Adjacent each cam follower 33 the side plate 29 is provided with a cut-out 36, the purpose of which will be apparent from the description below of the operation of the wheel. Also, the core 28 has a pair of circumferential grooves 37 into which extend two forks 38 which act as a belt-stripper. The operation of these is also described below.

In operation, the belt 10 passes round the wheel between the plates 29 and in contact with periphery of the core 28. The belt 10 is, of course, carrying clips 20, and as a clip 20 approaches the upper side of the wheel 13 it is partially received in a cut-out 36. The orientation of the clip is such that the arm of the U-shaped member 23 which carries the spring 25 and plate 27 is directed towards the cam follower 33. As the wheel continues to rotate the cam follower 33 is pivoted by the rising portion of the cam 35 so that it strikes the plate 27. This causes the U-shaped member 23 to move upwardly against the force of the spring 25, and thus allows the clip to release the edge of the film which has until now been held between the tip 26 and the adjacent part of the member 21. In this way each clip is successively released from the length of film and the film is thereby released from the belt 10. The film continues to travel in a left-ward direction and passes out of the apparatus through a suitable outlet, for example between a pair of rollers. The belt carrying the clips continues to travel around

the wheel towards the lower portion thereof. At the lower portion the reverse operation takes place. The lateral edge of a length of film introduced from the left hand side of the wheel passes between the tip 26 and the adjacent part of the member 21 of a succession of clips. As the wheel continues to rotate the cam follower reaches a sharply falling part of the cam 35, and pivots out of contact with the plate 27. Under the action of the spring 25 the tip 26 moves to engage the edge of the film, and the film edge is thus successively clamped by a plurality of clips.

A U-shaped yoke 39 partially surrounds the core 28 in order to prevent movement of the clips 20 perpendicular to the plane of the wheel 30 when they are engaged by the cam followers 33. The purpose of the stripper 38 is to assist in release of the belt 10 from the wheel. If this stripper is not provided there is a tendency for the clips to remain in the cut-outs 36 of the wheel after it has passed the lowest point on the wheel, and this gives rise to an undesirably jerky operation.

The film may be introduced into the apparatus in any suitable manner. One appropriate way is to load the film into a loading box so that it entirely enclosed with in the box except for a short lateral edge portion at its forward end. The entire box containing the film is then loaded into the apparatus in such a manner that the exposed lateral edge is engaged by a clip at the lower side of the wheel 13. The first clip to engage the film begins the process of withdrawing the film from the loading box, and the film is then successively engaged by a plurality of clips until the entire length of film has been withdrawn. When the film detector 15 senses that the length of film has been introduced into the apparatus the loading box can be withdrawn and a fresh length of film introduced in a similar manner. It will be appreciated that there are alternative methods of introducing the film. The embodiment described above with reference to Figures 1 to 4 employs a moving belt 10. As an alternative to this, the belt 10 may be replaced by a stationary track and the clips propelled along the track rather than moving with it. Figure 5 illustrates a section of an appropriate track and clip. A track 50 is supported by a track support 51. This may not always be necessary, depending on the inherent rigidity of the track, or it may only be necessary at certain points along the track. A plurality of clips 52 are arranged to slide on the track 50. The clips have a track engaging portion 53 which is so shaped as to prevent the clips falling off the track. A U-shaped film engaging member 54 is provided in the clip for engaging a film 55.

The clip member 54 is biased into engagement with the film 55 by a spring 56 one of whose ends bear against a plate 57 and the other of whose ends bears against a U-shaped carrier 58 in which the member 54 is received.

As is illustrated in Figure 6, the clips 52 are secured to a flexible cord 59 for movement therewith. The cord 59 is also visible in Figure 5. One form of drive wheel is also shown in Figure 6. The drive, labelled 60, has a plurality of cut-outs 61 each of which is shaped to engage a clip 52. The wheel is driven by suitable means, for example an electric motor, and this drive is imparted to the clips which in turn impart drive to the other clips via the flexible cord 59. It will be apparent that the spacing of the clips along the cord must be equal to or a multiple of the circumferential spacing of the cut outs 61. When the film is very narrow it is necessary to ensure that the spacing of the clips is such that the clips engage the film between adjacent frames. As will be apparent from Figure 7 the cord 59 is received in a circumferential groove in the wheel 60. Figure 7 also shows the means for engaging a film length with the clips 52. This means takes the form of a ring cam 62. The cam is arranged to open each clip 55 by the time it reaches the lower part of the wheel 60. It does this by having the plates 57 of the clips bear on the cam so as to cause the U-shaped member of the clips to move against the action of the spring 56. As the clip passes the lowest point on the wheel 60 the shape of the cam 62 allows the U-shaped member 54 to move back to a film-engaging position under the influence of the spring 56. In this way a succession of clips are caused to engage the edge of a length of film. The corresponding operation takes place in reverse at the upper side of the wheel, and here the cam (not illustrated at this location) causes the clip to disengage the film length which they are carrying.

It is not essential that the drive means and the film engaging and disengaging means should all be provided by a single device, as they are in Figures 6 and 7, and it would be possible to apply drive at one or more locations separate from a film engaging and disengaging device.

An alternative form of drive is shown in Figure 8. This differs from the drive shown in Figure 6 in that in Figure 8 the plane of the track is parallel to the axis of the drive wheel. The track-engaging part of each clip 52 is received in a cut-out 61' in a drive wheel 60'. The U-shaped part 58, the part 59, the spring 56 and the plate 57 are positioned in front of the drive wheel in the view shown in Figure 8. If desired, the form of drive shown in Figure 8 could be combined with a film engaging and film disen-

gaging device which could take the form of a cam positioned to be engaged by the plates 57 of the clip as they travelled around the wheel 60'. However, because of the

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It may be desirable under some circumstances for portions of the guide track to be omitted where the clips pass round the drive wheel, the drive wheel thus taking over the guiding of the clips in this region. A further modification which may be made is to

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#### WHAT WE CLAIM IS:—

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1. An apparatus for effecting treatment of an elongate piece of photographic material comprising a plurality of baths for containing photographic treatment materials a plurality of spaced clips adapted to engage a lateral edge region of the material, and means for moving the clips along a predetermined sinuous path through the baths, thereby to transport the piece of photographic material along the said path.

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2. An apparatus according to claim 1 comprising a feed station at which, in use, the said piece of material is engaged by some of the clips, a removal station at which the said piece of material is disengaged from the clips, and means for effecting engagement and disengagement of the clips.

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3. An apparatus according to claim 2, wherein the means for engagement and disengagement of the clips comprises a

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4. An apparatus according to claim 3, comprising a wheel having clip-engaging cut-outs, a pair of cam followers movable with the wheel, the cam being arranged to move the cam followers at the feed station and removal station to respectively cause engagement and disengagement of the piece of material by the clips.

5. An apparatus according to any one of claims 2 to 4, wherein the means for moving the clips comprises a flexible endless belt to which the clips are secured, guide means for guiding the belt along the predetermined path, and drive means for applying drive to the belt.

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6. An apparatus according to claim 5 as dependent on claim 4, wherein means are provided for stripping the clips from the wheel.

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7. An apparatus according to claim 2 or claim 3, comprising a stationary track extending along at least part of the said path, means on each of the clips to enable them to engage the track for guidance therealong, and a flexible cord to which the clips are attached.

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8. An apparatus according to any preceding claim, wherein each clip is provided with spring means for biasing it to a material-engaging position.

9. An apparatus according to any preceding claim, wherein a foam covered roller is arranged at at least one location on the said predetermined path between two adjacent baths so as to reduce transfer of photographic treatment material from one

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10. An apparatus according to any preceding claim, wherein a sensor is arranged to detect when the photographic material has passed a set point on the said predetermined path.

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11. An apparatus for effecting treatment of an elongate piece of photographic material substantially as herein described with reference to Figures 1 to 4 of the accompanying drawings, with or without the modification of Figures 5, 6 and 7 or Figures 5 and 8.

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COMPLETE SPECIFICATION

4 SHEETS

This drawing is a reproduction of  
the Original on a reduced scale  
Sheet 1

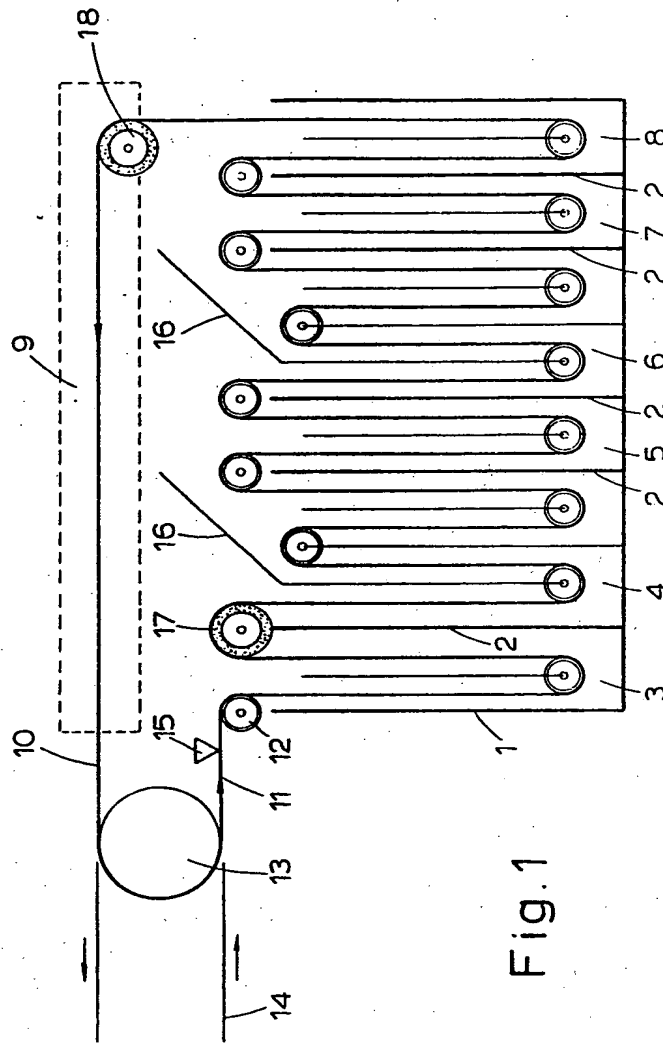


Fig. 1

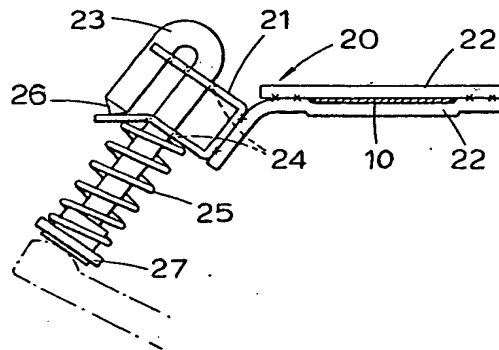


Fig. 2

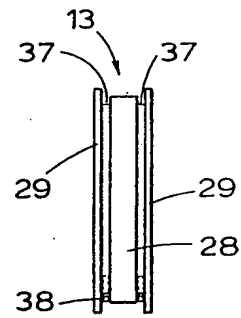


Fig. 4

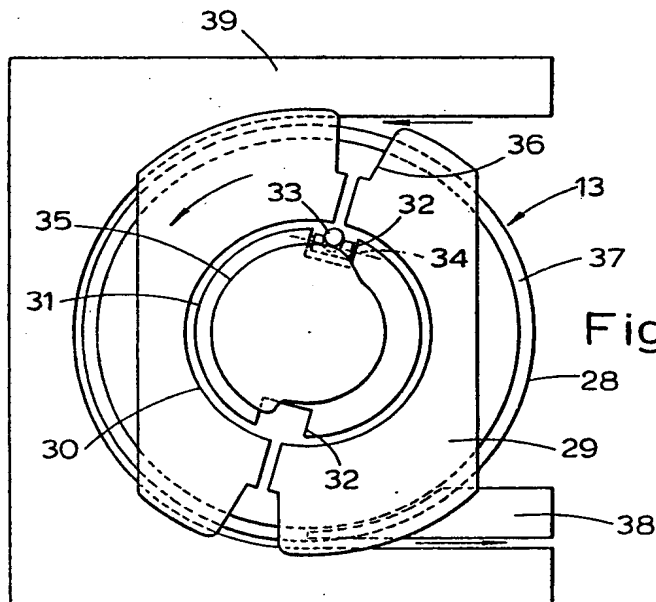


Fig. 3

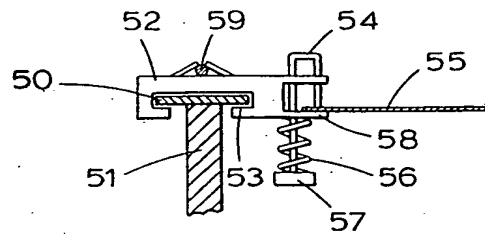


Fig. 5

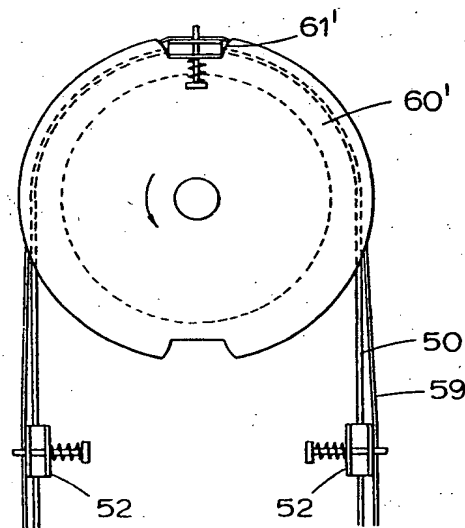


Fig. 8

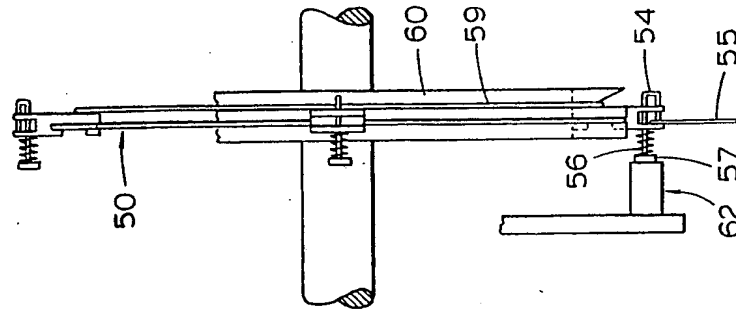


Fig. 7

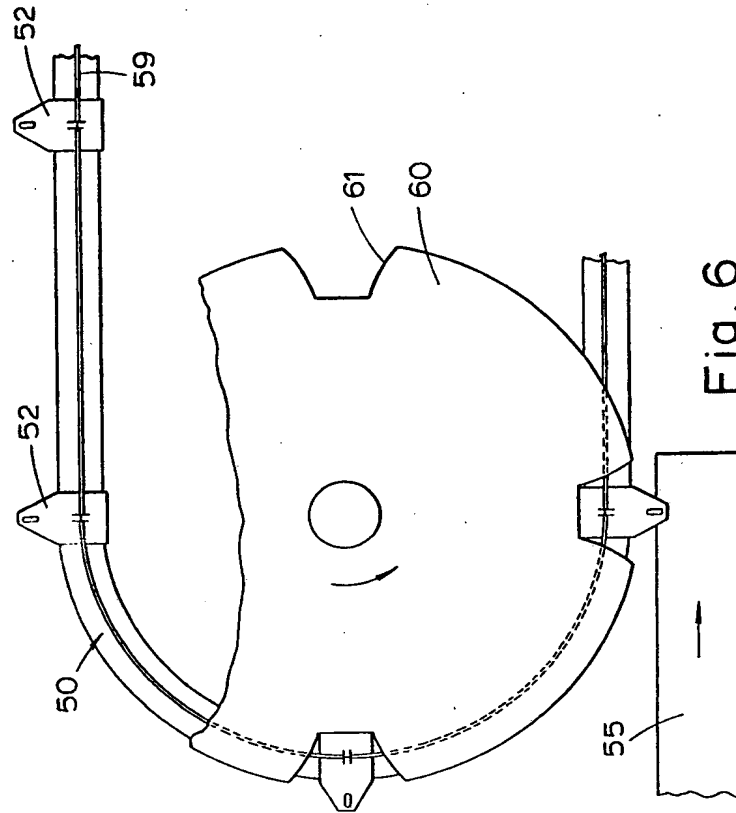


Fig. 6